No Data, No Prototype, and No Time to Lose

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Modeling atmospheric emergencies is the business of Livermore's National Atmospheric Release Advisory Center. Sullivan recounts overcoming significant obstacles when called on to assess the nuclear fallout from Chernobyl.

One Monday morning in April 1986, Marv Dickerson, project leader at the Atmospheric Release Advisory Capability (ARAC*), heard that radioactivity had been detected in the atmosphere over Sweden. He immediately contacted some friends in Sweden. The Swedes, he learned, had at first thought that an accident had occurred at one of their power plants. But now they determined that the radioactivity was coming from elsewhere. The Iron Curtain was still strong at this time, and communications from Russia were essentially zero. So even though the Swedes suspected a very large nuclear-power plant complex in Lithuania called Ignalina, they could only speculate, which meant that the release was from a source even farther away than Lithuania. That's when everyone realized that the radiation must have originated from a very severe accident at a nuclear reactor. That's when everybody started to query the Russians.

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Department of Energy (DOE) headquarters called Marv and asked how ARAC could help assess the consequences of this accident. At that time, ARAC only monitored a small area—about 200 kilometers—around each DOE and Department of Defense site in the United States. That seemed like a postage stamp compared to the area affected by the accident at hand.

I was the systems development team leader at that time, and George Greenly was the operations team leader. Monday afternoon, we gathered all the programmers and modelers together and asked, "What can we do? What are our limits?" We just knew that we would have to get bigger. On Tuesday when we found out where the accident had occurred, we realized that we'd have to magnify the ARAC system tenfold or more.

Tuesday morning, the Russians admitted an accident had occurred—not at Ignalina, but at Chernobyl, which was another 300 or 400 kilometers farther away. Immediately, everybody thought, and rightfully so, that this was a really severe accident. What made it worse was that it was obvious that much time had been wasted because of the lack of communication. It wasn't until Tuesday that we found out that the accident had actually occurred *Saturday morning*.

We had a preliminary plan of action, but we were lacking weather data for that part of the world. We faced three problems: how to make the model system big enough to deal with that area, how to obtain the weather data, and how to deal with the Russian's tardy acknowledgment that the accident had started on Saturday morning. This last problem was the trickiest since it meant we needed weather data for the past several days so that we could model the weather patterns. We had an agreement with the Air Force for them to provide us with weather data, but they only had current, real-time data. Any data older than a day or two had been taken off the Air Force's computer system and archived.

The Air Force agreed to stop their system at certain periods, go to the archive, reload the old data, and transmit it to us. But we had to be ready to catch the data when it came. Now this was before the Internet, when moving data was really difficult. So we would catch data for 2 to 3 hours at a time, trying to build our database. After a day and a half, we finally had weather data from about 6 hours before the accident to the current day.

We also needed meteorology charts, but again, we only had U.S. data—nothing for Russia. Our friends in the Air Force made copies of their paper charts and put them on an airplane. At about 9 p.m. on Tuesday, we received our first set of charts. The charts went back to the prior Saturday and helped us understand how the radiation had traveled to Sweden.

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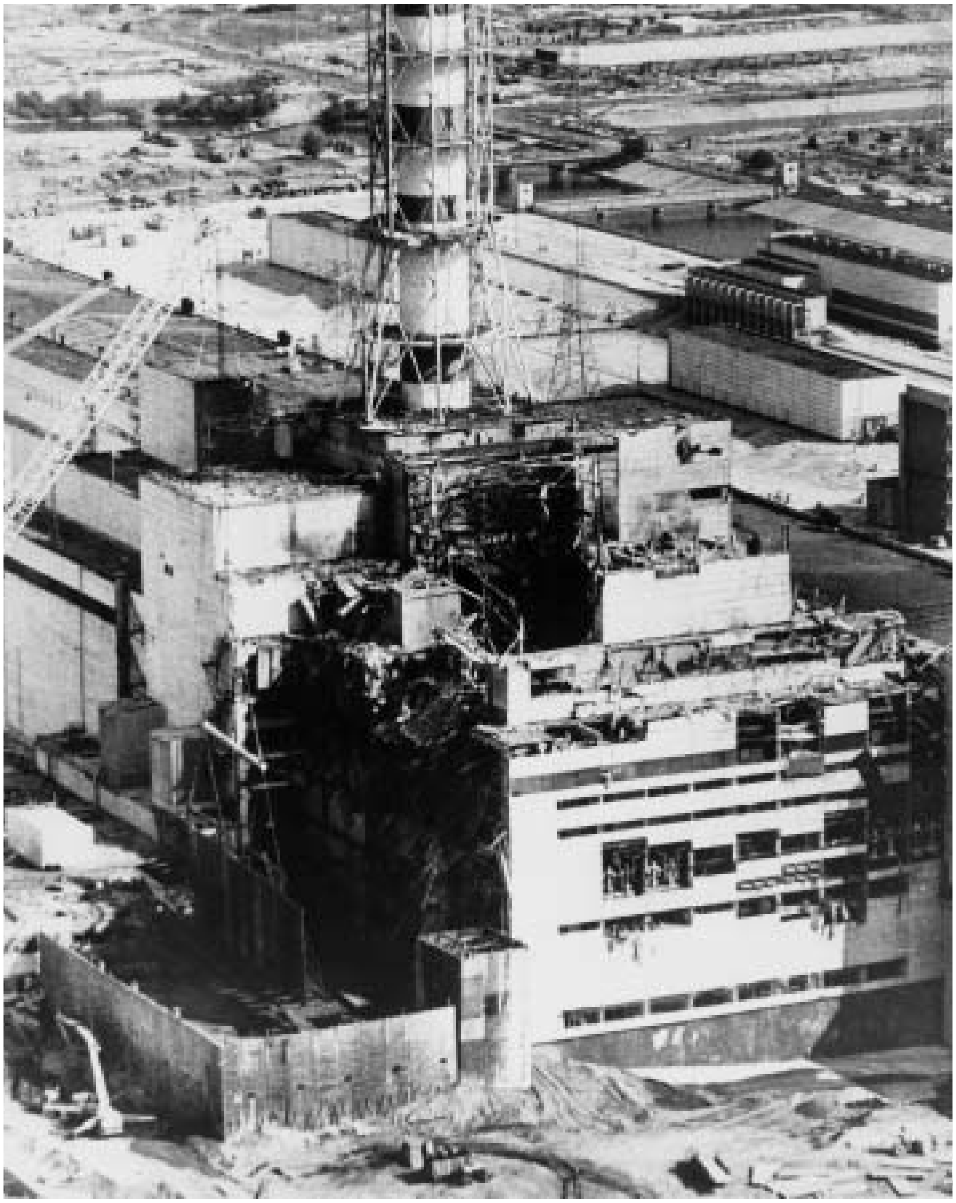
In the meantime, our computer scientists and modelers had been working feverishly to figure out how to ingest these data over a huge area, produce a background map (since we had no computer-digitized maps for that part of the world), and present the information so it would make sense—all enormous tasks. But the team really pulled through, building a modeling domain that was almost 2,000 kilometers on each side.

Then we ran into another problem. We had so much data that we exceeded the data capacity of the model, so we had to decide which data to keep in the model. George Greenly and I literally took a map of that part of the world, looked at the significant locations, and made decisions. We went around the map saying, "We'll use this. We won't use that." And so on.

About Wednesday evening, the data went into the code. One team of folks worked all night Wednesday into Thursday, running the model from just prior to the time of the accident to the present day. By Thursday morning, we had our first assessment. It was an amazing picture because it showed that the initial plume came out of Chernobyl, went northwest over the eastern corner of Poland, and then traveled out over the Baltic, and on up into Sweden and Finland. We were gratified because the model was consistent with past data as well as with what was actually happening in Europe.



Left: Marv Dickerson informs the media about the status of radioactive releases from the Chernobyl accident.
Above: The Chernobyl nuclear reactor after the accident.

We sent our first complete set of calculations to DOE headquarters on Thursday morning. DOE immediately told us to send the calculations to the Department of State, the Environmental Protection Agency, and several other agencies. This was back when faxes took 4 to 6 minutes each, so we had people faxing all day. We even ran out of fax paper. It was crazy.

Our office was inundated by media people, officials, and tour groups. The team was exhausted. People were so dedicated that we had to tell them to go home, especially after the second or third day when we realized that people had been in the office from 6 a.m. to 10 p.m. We started to worry about people being too fatigued to drive home.

The whole team was extraordinary, but so was the rest of the Lab who pitched in. There was so much work to be done that people couldn't even take a half-hour or 45 minutes to go to the cafeteria and get some food. We received a lot of help from the Laboratory cafeteria and our administrative people, who brought food to us. After a few days, a couple of spouses made some cookies, and people came in with stuff to eat. Everybody was running on sugar. We ate an awful lot of sweets—cakes, doughnuts, candies, and hot chocolate.

The bonding that happened during Chernobyl and other events has kept our team very solid to this day. Our team members had an experience that few other people have had. They successfully addressed the problem and could go away at the end, knowing that they had contributed to something big.